



# The BLUE JAY SCIENCE MAGAZINE

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## EDITORIAL

Dear readers,

Despite all the advancement in modern medicine, malaria takes over a million lives each year worldwide. To deal with it properly, both scientists and common man need better understanding of the disease. The cover story in this issue explains this deadly disease in detail. But not all phenomena are easy to explain as we see in the article 'Red rain'. The regular articles such as Science Capsule, Health is Wealth, Quiz Corner, Web Focus and Wildlife, are making science wonderful to know. I hope the readers will enjoy this mini-magazine dedicated to popularize science.

Bikash Ranjan Mohanty, Ph.D

## NEWS BYTES

### Scientists find world's biggest snake

Researchers have found fossils of the biggest known snake in the world that lived 58 to 60 million years ago and was around 13 meters long. It's a Titanic boa.

### Climate researchers in a spin after satellite loss

NASA's Orbiting Carbon Observatory (OCO) crashed into the ocean during launch on 24 February, which would have measured carbon dioxide concentrations in unprecedented detail, allowing scientists to track emission sources and identify 'carbon sinks' around the globe.

### Sunshine vitamin diminishes risk of colds, flu

Getting plenty of vitamin D — more than diet can offer — appears to provide potent protection against colds, flu and even pneumonia, a new study reports.

Courtesy — Nature News & Science News



Sushil Kumar Garnayak

In the developing countries many more deaths occurred due to infectious diseases and diseases that spread through mosquitoes. Malaria - a disease caused by a protozoan parasite that lives part of its life in humans and part in mosquitoes remains one of the major killers of humans worldwide. The World Health Organization estimates that each year 300-500

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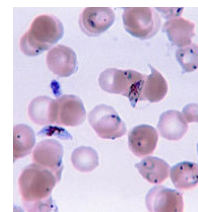
million cases of malaria occur and more than 1.2 million people die of it. Unfortunately most of its victims are young children and pregnant women.

Malaria typically is found in warmer regions of the world—in tropical and subtropical areas of Asia, Africa, and Central and South America. Higher temperatures allow the *Anopheles* mosquito to thrive. Malaria parasites, which grow and develop inside the mosquito, need warmth to complete their growth before they are mature enough to be transmitted to humans.

Until 1880 people believe that bad air is the real cause of malaria. In 1880, a French scientist Alphonse Laveran discovered, that the single-celled *Plasmodium* parasite is the real cause of malaria. Almost 20 years later, scientists working in India and Italy discovered that *Anopheles* mosquitoes are responsible for transmitting malaria.

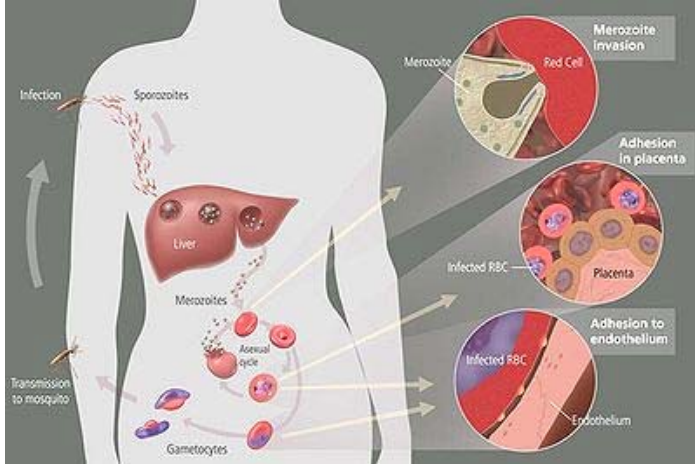
### Life Cycle of the Malaria Parasite and pathogenecity

The human malaria parasite has a complex life cycle that requires both a human host and an insect host. In *Anopheles* mosquitoes, *Plasmodium* reproduces sexually (by merging the parasite's sex cells). In people, the parasite reproduces asexually first in liver cells and then, repeatedly, in red blood cells (RBCs).



When an infected mosquito pierces a person's skin to take a blood meal, sporozoites (the infectious form of the parasite) in the mosquito's saliva enter the bloodstream and migrate to the liver within 30 minutes. There, each sporozoite develops into a schizont, a structure that contains thousands of tiny

rounded merozoites (another stage of the parasite), during the next 6-15 days (depending on the *Plasmodium* species). When the schizont matures, it ruptures and releases the merozoites into the bloodstream and infects red blood cells. Within the red blood cells, the parasites multiply further, again asexually, periodically breaking out of their hosts to invade fresh red blood cells. Several such amplification cycles occur. Thus, classical descriptions of waves of fever arise from simultaneous waves of merozoites escaping and infecting red blood cells.



Alternatively, some *P. vivax* and *P. ovale* sporozoites turn into hypnozoites, a form that can remain dormant in the liver for months or years. If they become active again, the hypnozoites develop into schizonts that then cause relapses in infected people.

The *Plasmodium* parasite completes its life cycle through the mosquito when some of the merozoites that penetrate RBCs do not develop asexually into schizonts, but instead change into male and female sexual forms known as gametocytes. These circulate in the person's bloodstream, awaiting the arrival of a blood-seeking female *Anopheles* mosquito.

When a female mosquito bites an infected person, it sucks up gametocytes along with blood. Once in the mosquito's stomach, the gametocytes develop into sperm-like male gametes or large, egg-like female gametes. Fertilization produces an oocyst filled with infectious sporozoites. When the oocyst matures, it ruptures and the thread-like sporozoites migrate, by the thousands, to the mosquito's salivary (saliva-producing) glands. The cycle starts over again when the mosquito bites its next victim.

### Symptoms of malaria

Symptoms of malaria include fever, shivering, arthralgia (joint pain), vomiting, headache, retinal damage and convulsions. Malaria may cause anemia (caused by hemolysis) and jaundice (yellow coloring of the skin and eyes), because of the loss of red blood cells. The classic symptom of malaria is cyclical occurrence of sudden coldness followed by

rigor and then fever and sweating lasting four to six hours, occurring every two days in *P. vivax* and *P. ovale* infections, while every three days for *P. Malariae* and *P. falciparum* can have recurrent fever every 36–48 hours or a less pronounced and almost continuous fever. Malaria has been found to cause cognitive impairments, especially in children. It causes widespread anemia during a period of rapid brain development and also direct brain damage. This neurologic damage results from cerebral malaria to which children are more vulnerable.

Infection with one type of malaria, *Plasmodium falciparum*, if not promptly treated, may cause kidney failure, seizures, mental confusion, coma, and death.

### Types of malaria

More than 100 different species of *Plasmodium* exist. They produce malaria in many types of animals and birds, as well as in humans. Only four types of the *plasmodium* parasite can infect humans. This group of human-pathogenic *Plasmodium* species is usually referred to as malaria parasites. The most serious forms of the disease are caused by *Plasmodium falciparum* and *Plasmodium vivax*.

*Plasmodium falciparum* is responsible for most malaria deaths, especially in Africa. The infection can develop suddenly and produce several life-threatening complications. With prompt, effective treatment, however, it is almost always curable.

*Plasmodium vivax*, the most geographically widespread of the species, produces less severe symptoms. Relapses, however, can occur for up to 3 years, and chronic disease is debilitating. Once common in temperate climates, *P. vivax* is now found mostly in the tropics, especially throughout Asia.

*Plasmodium malariae* infections not only produce typical malaria symptoms but also can persist in the blood for very long periods, possibly decades, without ever producing symptoms. A person with asymptomatic (no symptoms) *P. malariae*, however, can infect others, either through blood donation or mosquito bites. *P. malariae* has been wiped out from temperate climates, but it persists in Africa.

*Plasmodium ovale* is rare, can cause relapses, and generally occurs in West Africa.

### Transmission

Usually, people get malaria by being bitten by an infective female *Anopheles* mosquito. Only female mosquitoes feed on blood, thus males do not transmit the disease.

Because the malaria parasite is found in red blood cells of an infected person, malaria can also be transmitted through blood transfusion, organ transplant, or the shared use of needles or syringes

contaminated with blood. Malaria may also be transmitted from a mother to her unborn infant before or during delivery ("congenital" malaria).

Malaria is not spread from person to person like a cold or the flu, and it cannot be sexually transmitted. A person cannot get malaria from casual contact with malaria-infected people, such as sitting next to someone who has malaria.

### Diagnosis and treatment

Areas that cannot afford even simple laboratory diagnostic tests often use only a history of subjective fever as the indication to treat for malaria. The most economic, preferred, and reliable diagnosis of malaria is microscopic examination of blood films because each of the four major parasite species has distinguishing characteristics. In areas where microscopy is not available, or where laboratory staff are not experienced at malaria diagnosis, there are antigen detection tests that require only a drop of blood. Immunochromatographic tests (also called: Malaria Rapid Diagnostic Tests, Antigen-Capture Assay or "Dipsticks") have been developed, distributed and field-tested.

There are several families of drugs used to treat malaria. **Chloroquine** is very cheap and, until recently, was very effective, which made it the anti-malarial drug of choice for many years in most parts of the world. However, resistance of *Plasmodium falciparum* to chloroquine has spread recently from Asia to Africa, making the drug ineffective against the most dangerous *Plasmodium* strain in many affected regions of the world. In those areas where chloroquine is still effective it remains the first choice. Unfortunately, chloroquine-resistance is associated with reduced sensitivity to other drugs such as quinine and amodiaquine.

There are several other substances which are used for treatment and, partially, for prevention (prophylaxis). Currently available anti-malarial drugs include Cotrifazid, Doxycycline, Mefloquine, Primaquine, Proguanil, Sulfadoxine-pyrimethamine and Hydroxychloroquine.

The amount of anti-malarial drug transferred from the nursing mother to her infant is not thought to be harmful to the infant.

There is currently no malaria vaccine approved for human use. The malaria parasite is a complex organism with a complicated life cycle. Its antigens are constantly changing and developing a vaccine against these varying antigens is very difficult. In addition, scientists do not yet totally understand the complex immune responses that protect humans against malaria. However, many scientists all over the world are working on developing an effective

vaccine. Because other methods of fighting malaria, including drugs, insecticides, and bed nets, have not succeeded in eliminating the disease, the search for a vaccine is considered to be one of the most important research projects in public health.

### Prevention

Methods used to prevent the spread of disease, or to protect individuals in areas where malaria is endemic, include prophylactic drugs, mosquito eradication, and the prevention of mosquito bites.

In general, most travelers to an area with malaria are deferred from donating blood for 1 year after their return. People who used to live in malaria-risk areas cannot donate blood for 3 years. People diagnosed with malaria cannot donate blood for 3 years after treatment, during which time they must have remained free of symptoms of malaria.

Malaria has infected humans for over 50,000 years, and may have been a human pathogen for the entire history of the species. Although effective anti-malarial drugs are on the market, the disease remains a threat to people living in endemic areas who have no proper and prompt access to effective drugs. Access to pharmacies and health facilities, as well as drug costs, are major obstacles. The single most effective prevention is having people sleep under a mosquito net. The goal is simple: fighting malaria, one bed net at a time.

## SCIENCE CAPSULE

### What is Bluetooth?

BR Mohanty



Bluetooth is a wireless protocol for exchanging data over short distances from fixed and mobile devices. It can connect several devices, overcoming problems of synchronization.

A Bluetooth chip was initially designed to replace cables by taking the information normally carried by the cable, and transmitting it at a special frequency to a receiver Bluetooth chip, which will then give the information received to the mobile phones, telephones, laptops, personal computers, printers, Global Positioning System (GPS) receivers, digital cameras, and video game consoles. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 frequencies. It uses the microwave radio frequency spectrum in the 2.4 GHz to 2.4835 GHz range. Maximum power output from a Bluetooth radio is 100 mW, 2.5 mW, and 1 mW for Class 1, Class 2, and Class 3 devices respectively, which puts Class 1 at roughly the same level as mobile phones, and the other two classes much lower. Accordingly, Class 2 and Class 3 Bluetooth devices are considered less of a potential hazard than mobile

phones, and Class 1 may be comparable to that of mobile phones.

The word "Bluetooth" is an Anglicized version of the name of a tenth-century king, Harald Blaatand, king of Denmark and Norway, who united dissonant Scandinavian tribes into a single kingdom (as Bluetooth unites devices).

It was developed in 1994 by Jaap Haartsen and Sven Mattisson, who were working for Ericsson Mobile Platforms in Lund, Sweden.

## HEALTH IS WEALTH

### Hepatitis B

BR Mohanty

**A**n outbreak of hepatitis B in Gujarat, India, killed at least 49 people and infected over 125 last month.

Hepatitis B virus is a DNA virus of Hepadnavirus family that infects the liver and causes an inflammation called hepatitis. It has caused epidemics in parts of Asia and Africa, and it is endemic in China. About a third of the world's population, more than 2 billion people, have been infected with the hepatitis B virus. This includes 350 million chronic carriers of the virus. The infection is preventable by vaccination.



The hepatitis B virus primarily interferes with the functions of the liver by replicating in liver cells, known as hepatocytes.

Transmission of hepatitis B virus results from exposure to infectious blood or body fluids containing blood. Possible forms of transmission include (but are not limited to) unprotected sexual contact, blood transfusions, re-use of contaminated needles & syringes, and vertical transmission from mother to child during childbirth. Unlike Hepatitis A, Hepatitis B does not generally spread through water and food.

Acute infection with hepatitis B virus is associated with acute viral hepatitis - an illness that begins with general ill-health, loss of appetite, nausea, vomiting, body aches, mild fever, dark urine, and then progresses to development of jaundice. It has been noted that itchy skin has been an indication as a possible symptom of all hepatitis virus types. The illness lasts for a few weeks and then gradually improves in most affected people. A few patients may have more severe liver disease (fulminant hepatic failure), and may die as a result of it. The infection may be entirely asymptomatic and may go unrecognized.

Chronic infection with Hepatitis B virus may be either asymptomatic or may be associated with a chronic inflammation of the liver (chronic hepatitis), leading to

cirrhosis over a period of several years. This type of infection dramatically increases the incidence of hepatocellular carcinoma (liver cancer). Chronic carriers are encouraged to avoid consuming alcohol as it increases their risk for cirrhosis and liver cancer.

Several vaccines have been developed for the prevention of hepatitis B virus infection. These rely on the use of one of the viral envelope proteins (hepatitis B surface antigen or HBsAg). The vaccine was originally prepared from plasma obtained from patients who had long-standing hepatitis B virus infection. However, currently, these are more often made using recombinant DNA technology, though plasma-derived vaccines continue to be used; the two types of vaccines are equally effective and safe.

Vaccine is generally administered in two, three, or four dose schedules; and can be received by infants to adults. It provides protection for 85-90% of individuals, and lasts for 23 years. Infants may be vaccinated at birth. Acute hepatitis B infection does not usually require treatment because most adults clear the infection spontaneously. Although none of the available drugs can clear the infection, they can stop the virus from replicating, and minimize liver damage such as cirrhosis and liver cancer. Infants born to mothers known to carry hepatitis B can be treated with antibodies to the hepatitis B virus. Hepatitis B virus DNA persists in the body after infection and in some people the disease re-occurs.

### QUIZ CORNER

The world has celebrated 200<sup>th</sup> birth anniversary of Charles Darwin on

\_\_\_\_\_ 2009



Answer to February 2009 Puzzle Corner: **RECYCLE**

### RED RAIN – A MYSTERY

Swagatika Mohanty

**A** red rain phenomenon occurred in Kerala, India on 25th July 2001, in which the rainwater appeared coloured in various localized places that are spread over a few hundred kilometers in Kerala. The striking red colouration of the rainwater was found to be due to the suspension of microscopic red particles having the appearance of biological cells. These particles have no similarity with usual desert dust. An estimated minimum quantity of 50,000 kg of red particles had fallen from the sky through red rain. An analysis of this

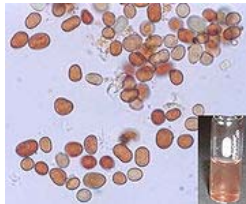


## WEB FOCUS

**Extreme Science** is the place online to find world records in natural science, including earth science and the plant and animal kingdom. Not only will you find out who holds the records, but also key science concepts used to explain the story behind the record. Visit <http://www.extremescience.com/>

strange phenomenon further showed that the conventional atmospheric transport processes like dust, storms etc. cannot explain this phenomenon.

The brownish-red solid separated from the red rain consisted of about 90% round red particles and the balance consisted of protozoans and debris. The particles in suspension in the rain water were responsible for the colour of the rain, which at times was as strongly coloured as blood. A small percentage of particles were white or had light yellow, bluish grey and green tints. The particles were typically 4 to 10 µm across and spherical or oval. Louis's images with a scanning electron microscope showed the particles as having a depressed centre, suggestive of biological cell, especially red blood cells. At still higher magnification some particles showed internal structures. Energy dispersive X-ray spectroscopy revealed that the particles were mostly carbon and oxygen with lesser amounts of hydrogen, nitrogen, silicon, chlorine and metals.



### Conventional hypotheses

At first, the red rain in Kerala was initially suspected due to dust from the deserts of Arabia. Centre for Earth Science Studies (CESS) and the Tropical Botanical Garden and Research Institute (TBGRI) jointly issued a statement that the particles colouring the rainwater were some type of spore. Then in November 2001, commissioned by the Government of India's Department of Science & Technology, the CESS and TBGRI released a report which concluded that the colour was found to be due to the presence of a large amount of spores of a lichen-forming alga belonging to the genus *Trentepohlia*. Field verification showed that the region had plenty of lichens. Samples of lichen taken from Changanacherry, when cultured in an algal medium, also showed the presence of the same species of algae. Both samples (from rainwater and from trees) produced the same kind of algae, indicating that the spores seen in the rainwater could most probably have come from local sources.

### Controversy

Then samples of these red particles were sent for analysis to Milton Wainwright at Sheffield University and Chandra Wickramasinghe at Cardiff University. Dr. Wainwright found that the red rain lacked DNA.

The controversial research of Louis and Kumar in 2003 is the only evidence suggesting that these organisms are of extraterrestrial origin. They posted a paper entitled "New biology of red rain extremophiles prove cometary panspermia" in which they reported that the microorganism isolated from the red rain of Kerala shows very extraordinary characteristics like ability to grow optimally at 300°C (572°F) and the capacity to metabolize a wide range of organic and inorganic materials.

## WILDLIFE

### Banded Krait

#### Scientific classification

Kingdom: Animalia  
Phylum: Chordata  
Class: Reptilia  
Order: Squamata  
Suborder: Serpentes  
Family: Elapidae  
Genus: *Bungarus*  
Species: *fasciatus*



Though venomous the banded krait is a shy snake, not typically seen, and is mainly nocturnal like all other kraits. When harassed they will usually hide their head under their coils, and do not generally attempt to bite, though at night they are much more active and widely considered to be more dangerous than. It can reach 8 ft in length.

It is easily identified by its alternate black and yellow bands and the marked vertebral ridge consisting of enlarged vertebral shields along its body. The head is broad and depressed. The eye is black. It has arrow-head like yellow markings on its otherwise black head and has yellow lips, lore, chin and throat. The body is triangular in cross-section.

It ranges from the Indian Subcontinent through Burma, Thailand, Indochina and southern China to Malaysia and the main Indonesian islands of Borneo, Java and Sumatra. It may be seen in a variety of habitats ranging from forests to agricultural lands. They inhabit termite mounds and rodent holes close to water, and often live near human settlement, especially villages because of their supply of rodents and water.

Diet consists of small mammals, lizards, frogs and toads. Sometimes they turn cannibalistic and begin feeding exclusively on snakes, often including other kraits and the cobra.

The female lays 6 to 12 eggs. Eggs are deposited in holes in the ground or under leaves.

Its venom is neurotoxic and has been estimated to be 7 to 14 times more potent than cobra venom.

All the science lovers are requested to submit their original articles pertaining to science to [bluejayscienceclub@gmail.com](mailto:bluejayscienceclub@gmail.com)